DOCUMENT RESUME

ED 097 519 CE 002 289

TITLE	Aircraft Sheet Metal Practices; Sheet Metal Work 2: 9855.01.
INSTITUTION	Dade County Public Schools, Miami, Fla.
PUB DATE	Apr 73
NOTE	20p.; An Authorized Course of Instruction for the Quinmester Program
EDRS PRICE	MF-$0.75 HC-$1.50 PLUS POSTAGE
DESCRIPTORS	*Aviation Mechanics; Behavioral Objectives; Course Content; Course Descriptions; *Curriculum Guides; Grade 11; Industrial Arts; Job Skills; Machine Tools; *Metal Working Occupations; Secondary Grades; *Sheet Metal Work; Shop Curriculum; Skill Development; *Trade and Industrial Education; Vocational Education
IDENTIFIERS	*Quinmester Program

ABSTRACT

The course outline will serve as a guide to the 11th grade student interested in sheet metal occupations. Requiring 135 clock hours, the basic course covers orientation and techniques in aircraft sheet metal. Emphasis will be placed on the proper use of tools and machines, safety, fabrication methods, aircraft materials, basic layout, and special fasteners. Teaching methods include lecture and demonstration techniques such as visual aids, mock-ups, cut-aways, transparencies, color slides, films, and manipulative shop practice. A bibliography lists reference books, manuals, and other instructional materials. A posttest sample concludes the curriculum guide. (MW)

ED 097519

BEST COPY AVAILABLE

AUTHORIZED COURSE OF INSTRUCTION FOR THE QUINMESTER PROGRAM

U S DEPARTMENT OF HEALTH
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION
THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

Course Outline
SHEET METAL WORK 2 - 9855
(Aircraft Sheet Metal Practices)
Department 48 - Quin 9855.01

CE 002 059

DADE COUNTY PUBLIC SCHOOLS
DIVISION OF INSTRUCTION • 1973

ED 097519

BEST COPY AVAILABLE

D A D E C O U N T Y P U B L I C S C H O O L S

1 4 5 0 N O R T H E A S T S E C O N D A V E N U E

M I A M I, F L O R I D A 33132

Course Outline

SHEET METAL WORK 2 - 9855
(Aircraft Sheet Metal Practices)

Department 48 - Quin 9855.01

county office of

VOCATIONAL AND ADULT EDUCATION

THE SCHOOL BOARD OF DADE COUNTY

Mr. G. Holmes Braddock, Chairman
Mr. William H. Turner, Vice-Chairman
Mrs. Ethel Beckham
Mrs. Crutcher Harrison
Mrs. Phyllis Miller
Mr. Robert Renick
Dr. Ben Sheppard

Dr. E. L. Whigham, Superintendent of Schools
Dade County Public Schools
Miami, Florida 33132

April, 1973

Published by the School Board of Dade County

Course Description

9855	48	9855.01	Aircraft Sheet Metal Practices
State Category Number	County Dept. Number	County Course Number	Course Title

This is a foundation quin course which will cover orientation and techniques in aircraft sheet metal. Emphasis will be placed on the proper use of tools and machines, safety, fabrication methods, aircraft materials, basic layout, and special fasteners. This is a three quinmester credit course.

Clock Hours: 135

PREFACE

The following quinmester course outline will serve as a guide to the high school student who wishes to pursue the field of sheet metal work. This is a first quinmester course for the eleventh grade.

This outline consists of eight blocks of instruction which are subdivided into several units each. The course is 135 hours in length.

In presenting the materials outlined in this course the instructor uses the lecture and demonstration methods with great empnasis on the use of visual aids, mockup, cut-aways, transparencies, color slides, films and manipulative shop practice.

No basic textbook is required for the course, however, the bibliography which appears on the last page of the outline lists the reference books, manuals, and other materials that are used throughout the course.

This outline was developed through the cooperative efforts of the instructional and supervisory personnel, the Quinmester Advisory Committee and the Vocational Curriculum Materials Service, and has been approved by the Dade County Vocational Curriculum Committee.

TABLE OF CONTENTS
with Suggested Hourly Breakdown

	Page
PREFACE	i
GOALS	iii
SPECIFIC BLOCK OBJECTIVES	iv
BIBLIOGRAPHY	v
BLOCK	
I. TOOLS (6 Hours)	
Handtools	1
Riveting Tools	1
Striking Tools	1
Cutting Tools	1
Turning Tools	1
Miscellaneous Tools	1
Special Tools	1
II. MACHINES (6 Hours)	
Cutting Equipment	2
Slip-Roll Forming Machine	2
Bending	2
III. SAFETY PRACTICES IN SHEET METAL SHOP (2 Hours)	
Precautions and the Protective Devices Used in a Metal Shop	2
Hazards Involved in Working in a Metal Shop	2
IV. FABRICATION METHOD (40 Hours)	
Fabricating Parts	2
Installing New Parts	2
V. AIRCRAFT MATERIALS (9 Hours)	
Selecting Aluminum Stock	2
Aluminum Extrusions	3
VI. BASIC LAYOUT (54 Hours)	
Lay Out Flat Patterns	3
Laying Out Irregular Patterns	3
Using Templates for Layout	3
Laying Out Airfoils	3
VII. SPECIAL FASTENER (18 Hours)	
Aircraft Types of Special Rivets and Fasteners	3
Select Acceptable Holes and Install Hi-Shear Rivets, Blind Rivets and Deicer Boot Fastener	3
Remove and Replace Special Rivets and Fasteners	4
VIII. QUINMESTER POST TEST	
APPENDIX: QUINMESTER POST TEST SAMPLE	8

GOALS

The student must be able to demonstrate:

1. An ability to recognize aviation sheet metal tools and machines, and their proper use.
2. The ability to safely and properly handle aircraft sheet metal equipment.
3. Techniques used in fabrication methods.
4. Recognition of the types of metals from which aircraft are made.
5. Techniques used in basic layouts.
6. Ability to install and remove special fasteners.

SPECIFIC BLOCK OBJECTIVES

BLOCK I - TOOLS

The student must be able to:

1. Identify and demonstrate the proper use of aircraft sheet metal tools.
2. Explain the care of and accounting for common and special tools.

BLOCK II - MACHINES

The student must be able to:

1. Demonstrate the proper use of cutting equipment.
2. Demonstrate the proper use of slip-roll forming machines.
3. Explain bend allowances and the use of metal bending machines.

BLOCK III - SAFETY PRACTICES IN SHEET METAL SHOP

The student must be able to:

1. Describe good safety practices in aircraft sheet metal work.
2. Set up safety program for metal shop.

BLOCK IV - FABRICATION METHODS

The student must be able to:

1. Define terms used in aircraft drawings.
2. Demonstrate making parts from drawings, original parts of templates.
3. Demonstrate the ability to install parts to the aircraft.

BLOCK V - AIRCRAFT MATERIALS

The student must be able to:

1. Recognize the type of metals from which an aircraft is made.
2. The ability to identify aircraft aluminum extrusions.

BLOCK VI - BASIC LAYOUT

The student must be able to:

1. Demonstrate laying out flat patterns.
2. Demonstrate laying an irregular pattern.
3. Exhibit the ability to use templates for layouts.
4. Demonstrate by laying out an airfoil.

BLOCK VII - SPECIAL FASTENERS

The student must be able to:

1. Identify types of fasteners used on aircraft.

2. Select acceptable holes and install special fasteners.
3. Remove and replace special rivets and fasteners.

BLOCK VIII - QUINMESTER POST-TEST

The student must be able to:

1. Satisfactorily complete the quinmester post-test.

Course Outline

SHEET METAL WORK 2 - 9855
(Aircraft Sheet Metal Practices)

Department 48 - Quin 9855.01

I. TOOLS

A. Handtools
   1. Identification
   2. Use of

B. Riveting Tools
   1. Rotary rivet cutter
   2. Rivet set
   3. Bucking bars
   4. Hole finder
   5. Skin fastener

C. Striking Tools
   1. Hammers
   2. Mallets
   3. Punches

D. Cutting Tools
   1. Diagonal cutting pliers
   2. Files
   3. Hacksaws
   4. Twist drills
   5. Countersinks
   6. Chisels
   7. Snips

E. Turning Tools
   1. Wrenches
   2. Screwdrivers

F. Miscellaneous Tools
   1. Mechanical fingers
   2. Flashlight
   3. Inspection mirror
   4. Steel rule
   5. Dividers
   6. Scriber
   7. Thickness gages

G. Special Tools
   1. Torque wrenches
   2. Spanner wrenches
   3. Tensiometer
   4. Rivet head shaver
   5. Pneumatic riveters

6. Rig pins
7. Strap wrench
8. Screw and bolt extractors
9. Throw boards

BEST COPY AVAILABLE

II. MACHINES

A. Cutting Equipment
   1. Squaring shears
   2. Throatless shears
   3. Hand bench shears
   4. Unishear
   5. Hand-operated turret

B. Slip-Roll Forming Machine
   1. Roller
   2. Rotary rolls
   3. Beading rolls
   4. Crimping rolls
   5. Wiring rolls
   6. Burring rolls
   7. Turning rolls

C. Bending
   1. Stake
   2. Vise
   3. Brake

III. SAFETY PRACTICES IN SHEET METAL SHOP

A. Precautions and the Protective Devices Used in a Metal Shop

B. Hazards Involved in Working in a Metal Shop

IV. FABRICATION METHODS

A. Fabricating Parts
   1. Making parts from drawings
   2. Making parts from originals
   3. Making parts from templates

B. Installing New Parts
   1. Fitting parts to the aircraft
   2. Attaching parts to the aircraft

V. AIRCRAFT MATERIALS

A. Selecting Aluminum Stock
   1. Identifying types of sheet aluminum by sight
   2. Identifying types of sheet aluminum by markings
   3. Identifying alloy markings

V. AIRCRAFT MATERIALS (Contd.)

BEST COPY AVAILABLE

4. Handling and storing aluminum sheet stock

B. Aluminum Extrusions
   1. Identifying shapes used in aircraft
   2. Identifying extruded shapes used in aircraft

VI. BASIC LAYOUT

A. Lay Out Flat Patterns
   1. Layout rivet locations
   2. Layout bend lines and relief holes
   3. Laying out angles
   4. Laying out curves

B. Laying Out Irregular Patterns
   1. Laying out intersection
   2. Laying out tapering sections
   3. Laying out transition pieces

C. Using Templates for Layout
   1. Laying out templates
   2. Trimming out templates to finished size
   3. Using template to lay out parts

D. Laying Out Airfoils
   1. Developing from table of ordinates
   2. Developing from duplicate part
   3. Developing by use of templates

VII. SPECIAL FASTENERS

A. Aircraft Types of Special Rivets and Fasteners
   1. Kind of special rivets used in aircraft repairs
   2. Pull type and explosive rivets
   3. Hi-shear rivets
   4. Riv-nuts and dill nuts
   5. Huck bolts
   6. Quick disconnect fasteners
   7. Precautions when using special rivets
   8. Removal and installation procedure for special rivets and fasteners
   9. Attachment and retention of special fasteners

B. Select Acceptable Holes and Install Hi-Shear Rivets, Blind Rivets and Deicer Boot Fastener
   1. Methods for checking and detecting acceptable drilled holes for hi-shear and blind-type rivets and deicer fasteners
   2. Determing correct size rivet or fastener for a given hole
   3. Installation tools for special rivets and fasteners

C. Remove and Replace Special Rivets and Fasteners
   1. Removal of special rivets
   2. Removal of special fasteners
   3. Replacement of quick disconnect type of fasteners
   4. Remove hi-shear rivets
   5. Remove blind-type rivets
   6. Remove deicer boot fastener
   7. Remove quick disconnect fastener - Replace each type of rivet and fastener previously removed

VIII. QUINMESTER POST-TEST

BIBLIOGRAPHY
(Aircraft Sheet Metal Practices)

Basic Reference:

None

Supplementary References:

1. Aero Publishers. Maintenance and Repair of Aerospace Vehicles. 3rd ed. New York: McGraw-Hill Book Company, Inc., 1963. Pp. 320.

2. Airframe Mechanic Written Exam Guide. Fort Worth, Texas: Acme School of Aeronautics, 1968. Pp. 63.

3. Alcoa Aluminum Handbook. Pittsburg: Aluminum Company of America, 1959. Pp. 222.

4. Boggess, Edward. Aircraft Sheet Metal Work. New York: Pitman Publishing Company, 1941. Pp. 117.

5. Forming Manual. Salt Lake City: Utah State Board of Vocational Education, 1942. Pp. 298.

6. Frazer, Russell. Practical Aircraft Sheet Metal Work. New York: McGraw-Hill Book Company, Inc., 1942. Pp. 193.

7. Giachino, J. W. Aircraft Sheet Metal Work. Peoria, Illinois: The Manual Arts Press, 1942. Pp. 123.

8. Leavell, Stuart, and Bungay, Stanley. Standard Aircraft Handbook. Los Angeles: Aero Publishers, Inc., 1952. Pp. 159.

9. Lemaster, Clarence Allen. Aircraft Sheet Metal Work. Chicago: American Technical Society, 1944. Pp. 117.

10. Nista, Albert H. Aircraft Riveting. New York: McGraw-Hill Book Company, Inc., 1942. Pp. 160.

11. Norcross, Carl. How To Do Aircraft Sheet Metal. New York: McGraw-Hill Book Company, Inc., 1942. Pp. 228.

12. Northrup Institute of Technology. Aircraft Maintenance and Repair. New York: McGraw-Hill Book Company, Inc., 1955. Pp. 444.

13. Overby, Charles A. Aircraft and Missile Design Maintenance Handbook. New York: The Macmillan Company, 1960. Pp. 320.

14. Rice, Ralph. Aero Mechanics Questionnaire. Los Angeles: Aero Publishers, Inc., 1955. Pp. 238.

15. Template Layout. Glendale, California: Aero Publishers, 1942. Pp. 306.

16. United States Department of Air Force. Air Frame Maintenance. Air Force Manual 52-11. Washington, D.C.: United States Government Printing Office, 1964. Pp. 314.

17. United States Naval Air Technical Training Command. Aircraft Structural Maintenance, Naupers 10308B. Washington, D.C.: United States Government Printing Office, 1969. Pp. 414.

Films:

1. Airframe Mechanic, The. 16 mm. 10 min. B/W. Sound. 1959. Jam Handy.

2. Airplane Structures. 16 mm. 45 min. B/W. Sound. 1945. Jam Handy.

3. Building PBY. 16 mm. 45 min. B/W. 1943. Consolidated Aircraft Corporation.

4. Forming Aluminum. 16 mm. 20 min. B/W. 1966. Alcoa.

5. How To Rivet Aluminum. 16 mm. 20 min. B/W. 1942. Alcoa.

A P P E N D I X

Quinmester Post-Test Sample

QUINMESTER POST-TEST

BEST COPY AVAILABLE

Name _____ Date _____ Score _____

Multiple Choice Test Items

Each statement needs a word, a figure, or a phrase to make it correct. Only one of the choices listed is correct. Place the number of the choice you make in the space provided at the right edge of the sheet.

---

1. Handtools discussed in this course are those which the mechanic (1) has in his hands, (2) has in his personal tool box, (3) checks out of tool crib, (4) does special jobs with. ( )

2. The hammer which is sometimes referred to as a machinist's hammer is (1) sledge, (2) planishing, (3) ball-peen, (4) mallet. ( )

3. Which of the following are considered cutting tools? (1) files, (2) countersinks, (3) hacksaws, (4) all of the above. ( )

4. A "rivet set" is a tool equipped with a die for (1) driving bolts, (2) up setting rivet tails, (3) a particular type of rivet, (4) cutting off rivets. ( )

5. The wrench that is often called "knuckle buster," is the (1) adjustable, (2) torque, (3) open, (4) box. ( )

6. A torque wrench is used to (1) measure the torque of propellers, (2) check the torque developed by turbine wheels, (3) tighten only special nuts, (4) measure the amount of turning or twisting force applied to a nut, bolt, or screw. ( )

7. Nearly all riveting is done with (1) ball-peen hammers, (2) draw sets, (3) pneumatic riveters, (4) electric riveters. ( )

8. In sheet metal, once a project has been laid out on the metal, the next step is to (1) cut it out, (2) paint it, (3) drill it, (4) heat treat it. ( )

9. Squaring shears may be (1) curved bladed, (2) straight bladed, (3) foot operated or power operated, (4) operated by men only. ( )

10. To form metal into a curve shape, and to produce a more accurate bend, you would use a (1) pipe, (2) slip-roll forming machine, (3) hammer and punch. ( )

11. The easiest and most accurate method of making straight-line bends on a piece of sheet metal is by the use of a (1) box brake, (2) pan brake, (3) cornice brake, (4) all of the above. ( )

BEST COPY AVAILABLE

12. The amount of material which is actually used in making the bend in metal is known as (1) bend radius, (2) bend allowance, (3) bend line, (4) bend tangent line.

13. The place where two sheets of metal are joined together is called a (1) joint, (2) overflow, (3) strap, (4) seam.

14. In bending metal, the radius of the bend is always to the (1) inside, (2) outside, (3) bottom, (4) top.

15. When laying out metal you should apply a (1) layout fluid, (2) soft heat, (3) layout lines, (4) layout table.

16. A scribe is used for drawing lines on aluminum (1) so it can be seen better, (2) for bend lines only, (3) where the metal is to be cut, (4) for straight lines only.

17. The purpose of dimensions on a drawing is to (1) insure good workmanship, (2) insure different views, (3) has no real purpose, (4) insure accuracy of the finished item.

18. In dimensioning distances between holes in an object, dimensions are usually given (1) outside to outside, (2) in inches, (3) from center to center, (4) inside to inside.

19. When making layouts for repairs on an aircraft, you may use (1) template, (2) identical part, (3) a blueprint, (4) all of the above.

20. On a drawing, length is usually the (1) dimension from side to side, (2) greatest dimension, (3) smallest dimension, (4) distance object rises above a surface.

21. In pattern development you must figure (1) color, (2) date of pattern, (3) size, shape and curve of the cuts, (4) size and weight of pattern.

22. In forming methods, extruded or formed angles are angles that (1) are cut off, (2) extend beyond the object being formed, (3) are heat treated before used, (4) are riveted on.

23. The principle aluminum alloy used in airplane structures is called (1) Alclad 2024, (2) stainless steel, (3) 18-8, (4) magnesium.

24. Pure aluminum in aircraft is used often on (1) odd shape parts, (2) structural parts, (3) nonstressed parts, (4) stressed parts.

25. Extrusions are formed by (1) forming metal in presses, brakes and rolls, (2) forcing heated metal through dies of desired shape, (3) pouring molten metal into molds, (4) hammering or pressing the metal into shape.

26. Formings are produced by (1) forming the metal in presses, brakes, and rolls, (2) forcing metal under pressure through dies, (3) pouring molten metal into molds, (4) heating to several hundred degrees, then cooling.

27. Why is aluminum important in aircraft construction? (1) Because of its high strength to weight ratio, (2) Because of its corrosion resistant properties, (3) Because of its ease of fabrication, (4) All of the above.

28. Wrought aluminum alloy are classified as either (1) strain hardened or annealed, (2) strain hardened or nonheat treatable, (3) heat treatable or nonheat treatable, (4) heat treatable or annealed.

29. Aluminum alloys are available in what two basic forms? (1) Heat treatable or nonheat treatable, (2) Wrought and cast, (3) Cold worked and annealed, (4) Heat treated and annealed.

30. Most aircraft bolts are made of (1) aluminum, (2) zinc, (3) magnesium, (4) nickel steel.

31. An AN-3 through an AN-20 are general-purpose aircraft bolts used for (1) compression loads, (2) tension or shear loads, (3) steel brackets, (4) aluminum fittings.

32. The size or diameter of the rivet you select should be in relation to the (1) headsize, (2) length of material being riveted, (3) thickness of material being riveted, (4) types of material being riveted.

33. Cherry rivets, two part mechanically expansible rivets, are used as permanent fasteners on surfaces (1) which are not too thick, (2) which are identically to each other, (3) which can be reached from only one side, (4) which have zinc chromate primer only.

ANSWER KEY TO QUINMESTER POST-TEST

1. (2)
2. (3)
3. (4)
4. (3)
5. (1)
6. (4)
7. (3)
8. (1)
9. (3)
10. (2)
11. (4)
12. (2)
13. (4)
14. (1)
15. (1)
16. (3)
17. (4)
18. (3)
19. (4)
20. (2)
21. (3)
22. (2)
23. (1)
24. (3)
25. (2)
26. (1)
27. (4)
28. (3)
29. (2)
30. (4)
31. (2)
32. (3)
33. (3)